Nature Decoded

history of material life. Those who can emulate Dr. Multhauf's example may realize an opportunity to bring their specialty into a mainstream of modern historiographical concern.

As to the physical aspects of *Neptune's Gift,* it should be said that it maintains the very high standards of design established in the Johns Hopkins Studies in the History of Technology. The text is munificently illustrated and fairly bristles with substantial tables and charts, the most pleasing feature of which is their juxtaposition on, or adjacent to, the appropriate page of text. Unfortunately the technology of production does not quite match the skill of design: the text is printed on a high-gloss paper that makes reading a sore strain in artificial light.

Finally a postscript would seem appropriate at this time and in this place. For fifteen years Dr. Multhauf labored as editor of *Isis* to improve the style and substance of the output of historians of science. We now know how he brought savor to his task and at the same time did not fall victim to credulity. On all scores we owe him our congratulations and our gratitude.

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Nature decoded

Barry Barnes; Steven Shapin (Editors). *Natural Order: Historical Studies of Scientific Culture.* 255 pp. Beverly Hills/London: Sage Publications, 1979. $17.50 (cloth); $8.95 (paper).

For at least a generation, would-be innovators in the history of science have railed against the distinction between so-called internal and external approaches to the scientific enterprise. At the same time a growing minority of practitioners have dealt with context and social location in explaining particular scientific developments. The present collective work constitutes a particularly forceful contribution to this continuing tradition.

The editors argue that scientific concepts, like man's other cultural products, are fully understandable only in their "context of use." This context can reflect religious or regional identity, the needs of a particular class grouping, or a generational difference in perception; it can reflect as well the diversity of training, institutional affiliation, and aspiration *within* modern scientific disciplines. Scientific ideas are thus metaphor and tool, not simply ever closer simulations of a natural reality. For if there is a particular other against which the editors and contributors define themselves, it is those historians and philosophers of science who treat scientific ideas as "Platonic essences, by virtue of which their purity is guaranteed against the effects of any mere contingency" (p. 132). It is the very boundary between the realms of logic and contingency which they hope to eradicate, substituting for it an interface in which social, cultural, and institutional factors interact to shape particular scientific ideas. "The use of cultural resources to construct scientific theories is an observation of what happens," as they put it, "not the casting of an aspersion" (p. 138).

The editors' title is precisely appropriate. *Natural Order* implies man's need both to create a predictable order in his particular world and to see that order as legitimate inasmuch as it mirrors relationships that are intrinsic, inexorable, and thus transcendent. More immediately, the title invokes the academic program of Mary Douglas by echoing the title of her much-quoted *Natural Symbols.* For the editors

find in her work a powerful assertion both of the cultural significance of symbolic structures and of the necessity of seeing such world-ordering conceptions in a "context of use," as growing out of specific social realities. By invoking the anthropologist's relativist perspective, moreover, they subvert the vision of science as culture-free cognitive system. It is to see the ideas of eighteenth- and nineteenth-century science as part of a continuum that includes Semitic nomads, Trobriand Islanders, Azande medicine men, and Bog Irishmen in London. Barnes and Shapin have shrewdly endorsed a position which has both polemical strength and a practical efficacy in justifying a flexible range of research options.

Almost any aspect of culture or of a scientific discipline is—in Barnes' and Shapin's formulation—a potential factor in shaping cognitive forms. The general point, as Donald MacKenzie and Barry Barnes put it, "is not that the goal-oriented character of scientific judgment implies its relationship to any particular contingency, or to external factors, or political interests; what is implied is that any such contingency *may* have a bearing on judgment and that contingent sociological factors *must* have. What these factors are is always a matter for concrete empirical investigation" (p. 205). This is a position so tentative and eclectic that it almost approximates the theory-starved practice of a good many historians.

Further, if one ignores the last few essays, which deal with the twentieth century—about these more later—the book can be seen as having a specific historical subject as well as a programmatic thrust. This is the shift in worldview of educated and articulate Britons between the mid-eighteenth and early twentieth centuries, especially the way in which concepts about the natural world served in various ways as an adaptive mechanism, allowing particular groups and individuals to legitimate new roles and new ambitions in comforting worlds of metaphor. This book might well have been subtitled: *Science, Social Change, and Worldview in Modernizing Britain.* For almost every essay in the first three-quarters of the book turns on the way in which particular groups coped with new social situations through the manipulation of words and symbols. Christopher Lawrence, for example, sees the creation of a particular metaphorical view of the body emerging from changing social hierarchies in eighteenth-century Scotland, mirroring the "social interests and self-perceptions of the improving landed class." Shapin views the particular form and content of phrenology as associated with the values and perceptions of a predominately urban middle class. In an even more expansive formulation, Roger Cooter pictures the didactic popular physiology of nineteenth-century England as having "facilitated people's entry into and rationalization of the bourgeoise social hegemony." Roy Porter's study of "Creation and Credence: The Career of Theories of the Earth in Britain, 1660–1820," traces in more cautious fashion the decline of those hierarchy-embodying cosmologies which flourished in the late seventeenth and early eighteenth centuries. Mathematics represents a particularly "hard case" for advocates of contextual approaches to the history of science, and in an ingenious essay Joan Richards argues that the tardiness of English mathematicians in accepting non-Euclidean geometry had much to do with the epistemological—and thus social—status of geometry in nineteenth-century England. Geometry served as a key argument for the existence of absolute truth attainable through other than empirical means—"from truth which could be gained through mere deduction from a series of experiments" (p. 148). Richards's case study is neatly supplemented by Brian Wynne's examination of parallels between an interest in psychic phenomena on the part of certain English physicists and their technical position in regard to the role of ether in physical theory.

All of the essays in the early part of the book relate to the way in which cultural factors shape scientific ideas or to the way scientific ideas can serve as modes of visualizing and thus controlling society for at least some of its members. There is a nagging asymmetry, however, in the balance of case studies provided. Despite the

editors' programmatic emphasis on the need to see sociological factors within the modern scientific disciplines as appropriate variables, only a few of the essays illustrate this approach. And this is unfortunate polemically as well as intellectually. For few historians in the 1970s would doubt or question the way in which scientific formulations served to rationalize and mediate social relationships, even define social identities in the cultural and economic transformations of the nineteenth century. It is another—and perhaps more intractable—problem to demonstrate the way in which contingent circumstances within the modern scientific disciplines, questions of training, of recruitment, of institutional affiliation and ambition, determine the particular shape of the knowledge produced by that discipline.

Only two of the essays address themselves explicitly to such questions. Donald MacKenzie's and Barry Barnes's elegant study of the Mendelian-biometrician controversy suggests that an impressive range of factors shaped the conflict, some internal to the world of academic biology and others relevant to the protagonists in their role as members of a particular class at a particular moment in time. In an essay on the continuing controversy between biosystematists and more traditional descriptive taxonomists, John Dean provides an even more sharply defined instance in which factors internal to the social anatomy of the relevant disciplines explain how two very different orientations toward an appropriate basis for botanical taxonomy have co-existed for decades.

Thus far all well, and in general good. Yet this collection illustrates as many problems as it provides solutions. One lies in the reductionist functionalism that characterizes many of the essays. A problem is posed, an interest suggested, the veils of ideological obfuscation pulled back, and a more fundamental truth emerges. In treating science as ideology, that is, the contributors tend to reduce ideas to their functional utility to particular groups. It must be obvious, moreover, and it is to most of the authors when they are not betrayed by their own rhetoric, that *a* function is not *the* function and that function is not meaning, certainly not to the individuals who believed and articulated the ideas under discussion. Yet the dénouement of these essays tends to assume a rather more one-dimensional form. Let me cite a passage from Brian Wynne's contribution: "There is a striking analogy between the ineffable, unseen ethereal basis of matter and the articulation of an ineffable spiritual and transcendent basis of social reality—the conservative ideological response to bourgeoise individualism" (p. 180). I do not mean to single this essay out; parallel passages could be culled from at least half of the chapters. Such facile connection between social location and the form of a particular idea removes the historical actor from that very richness of context in which Barnes and Shapin would have him placed.

I use the term facile with care and some regret. Although I admire these essays, the book is too often dotted with just such facile imputations. It is marked as well by a kind of paradoxical idealism. Despite a good many references to contexts and the multiplicity of factors within and without the academic disciplines, the contributors almost never place their protagonists in an appropriately detailed social location. References to landed elements or upwardly mobile bourgeois groups are simply too imprecise. As Shapin himself so eloquently argues, it is no longer meaningful simply to assert that scientific knowledge can be referred to social factors. "The task is the refinement and clarification of the *ways* in which scientific knowledge is to be referred to the various contextual factors and interests which produce it" (p. 42). If this is the case—as common sense tells us it must be—then historians of natural knowledge must be particularly careful to define precisely the intellectual communities to be studied and their social and institutional affiliations. Despite the invocation of Mary Douglas, the figure most immanent in these essays is Arthur O. Lovejoy—for it is the tools of the historian of ideas, not those of the sociologist, social historian, or symbolic anthropologist, which the authors find most comfortable in hand.

There is another and even more elusive problem in addressing the social factors which shape intellectual products, and that is specifying the meaning of their participation to the actors. A number of possible views on what that meaning is are represented in *Natural Order*. Cooter sees popular physiology as an opiate of the masses, playing a hegemonic role in creating a disabling false consciousness among potential working-class leaders. He imputes, I am afraid, rather more power to scientific ideas than many, including this reviewer, would grant them. Cooter's interpretation implies, moreover, almost insuperable problems of evidence. A softer position would limit interpretation to the benefits accruing to the individuals actually articulating such ideas, in most of the cases suggested here small groups of self-conscious intellectuals. A few nineteenth-century Englishmen were attracted by the role of scholar and made the articulation of scientific ideas central to their sense of social identity. Exercises in self-assurance, however, should not be confused with objectively effective weapons in the working out of class antagonisms, even though these functions may in some ways overlap.

Such problems are clear enough to the editors. Their mode of dealing with them is to endorse an elegant and defensible eclecticism which assumes multiple causation and levels of meaning. Their method assimilates history of science to contemporary history more than to anthropology or sociology. But to demystify science and move it from sacred to secular time substitutes a different kind of dilemma for the internalist's world of autonomous cognitive events: the historian's seamless web, an interpretive wilderness in which everything is potentially relevant to everything else.

By way of conclusion, let me suggest that this book might itself be understood as an object of the same sort of analysis it prescribes for other cultural artifacts. Like the case-studies in the social origins of esoteric knowledge it provides, this book can at some level be understood only in its relationship both to society generally and to the esoteric knowledge community to which it is specifically addressed. Thus the book is characterized by the anti-authoritarianism so widespread in recent political attitudes. To deny the transcendence of scientific knowledge is, after all, a political act. The contextual approach to science is a social tool as well as an epistemology, taking knowledge which had seemed eternal, disinterested, inevitable and arguing that it was provisional, interested, a result not of the iron logic of eternal ideas, but of particular mundane interests. In the past generation we have seen parallel arguments used to undermine the social claims of scientific knowledge and its bearers in debates over issues as diverse as medical care and institutionalization, the place of women, government policies in regard to energy, environment, and war.

Within the discipline of history of science, of course, an aggressive contextualism must necessarily appear in opposition to a once-dominant internalism (despite the editors' unwillingness to accept the legitimacy of that distinction). The contributors are careful to define their intellectual identity, moreover, by avoiding a number of contemporary approaches potentially relevant to their concerns. If they dismiss the mandarinism of science as culture-free cognitive system, they are equally firm—if less explicit—in their rejection of the formal externalism of a Merton or Ben-David. The contents of ideas are of fundamental importance to the authors of *Natural Order,* yet at the same time revelatory of social reality—indeed an inextricable part of that social reality.

This general emphasis is hardly novel. In the field of medical history alone one could mention such names as Sigerist, Shryock, Rosen, Pagel, Ackerknecht—all advocates and practitioners of a history that placed ideas in specific contexts and explained them in terms of their social uses. But none of these scholars contemplated quite so categorical an assimilation of science and its works to the realm of the contingent and the culturally defined. Most scholars would still concede that there is *something* peculiar about the way in which ideas function in modern scientific

disciplines; yet such a difference simply adds another layer of complexity to the web of social explanation so forcefully argued in *Natural Order*. For the program which Barnes and Shapin outline with such enthusiasm is forbidding indeed: to recreate the context of ideas, pinpoint the social place of knowledge producers, evaluate the subtle ways in which social perception influences the choice among intellectual options. The facility which occasionally mars these essays is no more than inadvertent evidence of the difficulties inherent in the laudable task the essayists have undertaken.

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Collegium historicum

David C. Lindberg (Editor). *Science in the Middle Ages.* (Chicago History of Science and Medicine series.) xv + 549 pp., illus., bibl., index. Chicago/London: University of Chicago Press, 1978. $40.

Among readers of this journal, at least, "medieval science" is no longer regarded as a contradiction in terms. Nevertheless the phrase still presents many problems of connotation and denotation that are not similarly felt with regard to Greek science or to modern science. A characteristic of the pioneer investigators in the subject was to identify in the Middle Ages attributes that were similar to those of later science. In this way "medieval science" was defined by similarity of connotation with modern science, and could be seen as clearly preparing the way for the emergence of the latter. Classic examples were Pierre Duhem's assimilation of impetus theory to seventeenth-century mechanics and his claim that Nicole Oresme invented analytical geometry. In like manner writers such as John Herman Randall and Alistair C. Crombie tried to link the Middle Ages to modern times by means of methodological discussions, while Lynn Thorndike saw in the murkier field of magic a true breeding ground of experimental science. Meanwhile George Sarton's *Introduction to the History of Science* came to a shuddering if splendid halt in the fourteenth century. He had overcome his earlier "scientist's" attitude to the Middle Ages and was now being overwhelmed by the wealth of material that he saw as essential to the history of science. "There was no annus mirabilis in the fourteenth century. . . . It does not follow, as so many ignorant persons think, that the mediaeval activities were sterile. That would be just as foolish as to consider a pregnant woman sterile as long as the fruit of her womb was unborn" (Vol. III, p. 15).

With the territory being thus staked out study could proceed less apologetically, and an immense amount of scholarly work has appeared. One thinks particularly of that produced by Marshall Clagett and his academic descendants, many of whom contribute to the present volume. With this there are signs of changing orientations. If earlier investigators were largely guided by connotative similarities, it soon became apparent that the texts thus chosen to represent medieval science were in the Middle Ages often closely linked with other texts that did not seem scientific by the same criteria. But this closeness suggests a need to widen the denotation of the term "medieval science"; or perhaps, now that the Middle Ages has been established as a legitimate area of investigation for historians of science, to be wary of using the term "science" at all. The question is not simply one of semantic quibbling or demarcation disputes, for if science is so inextricably entwined with philosophy and theology, we